heterogeneous freezing, have been explored using the microphysical model. Homogeneous freezing at a rate of 10^4 cubic centimeters per second ($cm^{-3}s^{-1}$) produces particles comparable to observations. However, the PSCs form too frequently (observations often show a lack of solid-phase PSCs well below the nitric acid trihydrate (NAT) condensation point), and the altitude variation is not well captured. For homogeneous freezing to explain the observations, the freezing rate must have a complex dependence upon the local conditions.

On the other hand, PSCs that form by heterogeneous freezing are strongly affected by the winter-long PSC processing; that is, denitrification removes most of the nuclei. The resulting model correlation between denitrification and particle concentration is comparable to the ER-2 observations. In addition to providing an explanation for the occasional absence of solid-phase PSCs, this process also explains why denitrification did not exceed 80%.

To understand the winter-long implications of these findings, the model has been run from November to mid-April, using a large set of trajectories that provided representative coverage of the entire Arctic vortex through the period of PSC formation and ozone depletion. The various possible freezing processes have been shown to have different characteristics in terms of the overall extent of frozen particles, the evolution of the PSCs, denitrification, and dehydration. Scenarios with freezing above the ice frost point lead to widespread denitrification. This denitrification enhances the ozone loss at the end of the winter by up to 30%, as long as the vortex remains stable until late March.

Point of Contact: Katja Drdla
(650) 604-5663
katja@aerosol.arc.nasa.gov

Global Aerosol Climatology Project

Peter Pilewskie, Warren Gore, and Larry Pezzolo

In June and July, 2000, Ames personnel participated in the Puerto Rico Dust Experiment (PRIDE), a multi-agency field study of the radiative, microphysical, and transport properties of Saharan dust. There were two primary objectives: (1) determine the extent to which the properties of dust particles and the spectral surface reflectance of the ocean surface need to be known before remote sensing systems can accurately determine optical depth and flux; and (2) evaluate/validate the skill with which the Naval Research Laboratory's Aerosol Analysis and Prediction System (NAAPS) predicts the long-range transport and vertical distribution of African dust.

The results of these efforts will support U.S. Navy and NASA applied science objectives on satellite validation and the prediction of dust-induced visibility degradation. In addition, secondary efforts of PRIDE will address in situ issues of coarse mode particles and basic research issues on climate forcing, geochemical cycles, and meteorology.

Ames' specific contributions to PRIDE were to provide measurements and analyses of solar spectral fluxes. The Ames Solar Spectral Flux Radiometer (SSFR) was deployed on the Space and Naval Warfare Systems Command (SPAWAR) Navajo aircraft, measuring upwelling and downwelling spectral irradiance

between 300 and 1700 nanometers (nm). A similar SSFR was deployed at a ground site to obtain downwelling irradiance at the surface. The data will be used to determine the net solar radiative forcing of dust and other aerosols, to quantify the solar spectral radiative energy budget in the presence of elevated aerosol loading, to support satellite algorithm validation, and to provide tests of closure with in-situ measurements.

In August/September 2000, Ames personnel participated in the South African Regional Science Initiative (SAFARI 2000), an international science initiative aimed at developing a better understanding of the southern African Earth/atmosphere/human system. The goal of SAFARI 2000 is to identify and understand the relationships between the physical, chemical, biological and anthropogenic processes that underlie the biogeophysical and biogeochemical systems of southern Africa. Particular emphasis will be placed upon biogenic, pyrogenic, and anthropogenic emissions, their characterization and quantification, their transport and transformations in the atmosphere, their influence on regional climate and meteorology, their eventual deposition, and the effects of this deposition on ecosystems.

During SAFARI 2000, the SSFR was deployed on the NASA ER-2, the University of Washington CV-580, and at a ground site in Kruger National Park. Data will be used to characterize the spectrally dependence of cloud and aerosol radiative forcing.

Maura Rabbette and John Pommier, Bay Area Environmental Research Institute and Steve Howard, Symtech Corporation, collaborated with the Ames investigators on this project.

Point of Contact: Peter Pilewskie
(650) 604-0746
ppilewskie@mail.arc.nasa.gov

In-Situ Measurement of Particle Extinction

Anthony W. Strawa and Rudolf F. Pueschel

Aerosol optical properties are extremely important in assessing climate change. The lack of sufficient knowledge of aerosol optical properties and their variability in the atmosphere have led the Intergovernmental Panel on Climate Change to rate the effect of aerosol as the most uncertain of all parameters considered important to climate change. Currently, these aerosol properties are obtained from filter samples that measure absorption of black carbon aerosols on a time scale of tens of minutes to hours. Aerosol variability causes significant changes in optical properties on the order of seconds, especially when sampled from aircraft. Thus, the research community is very interested in an instrument that can measure the optical properties of all aerosols, not just black carbon, on a time scale of seconds. The instrument developed by a commercial vendor can meet these expectations and has the capability to revolutionize the measurement of aerosol optical properties.

Ames is working with the vendor to develop an innovative instrument using cavity ring-down absorption spectroscopy (CRDS) to measure the extinction and scattering coefficients of aerosol, and consequently, the single-scatter albedo. The prototype instrument demonstrates: (1) fast and accurate measurement of aerosol extinction, (2) measurement of aerosol scattering in a CRDS system, and (3) simultaneous measurement at two laser wavelengths. The instrument proved capable of measuring